What is claimed is:

1. A method of forming an high-resolution image of a pattern formed on an image transducer comprising an array of programmable microelements, wherein an edge of the high-resolution image is placed to a select fraction of the width of a microelement, the method comprising the steps of:

a) establishing n = 2 different patterns to be displayed by the image transducer; and

b) sequentially pulse-exposing the m^{th} pattern in the n = 2 different patterns 2^{m-1} times, with the total number of partial exposures being 2^n-1, wherein m and n are integers, and m = n, so as to form corresponding plurality of images; and

c) superimposing the plurality of images to form the high-resolution image.

2. A method according to claim 1, wherein said step c) includes the step of:

i) directing the plurality of images onto a photosensitive recording medium to record the high-resolution image therein, the recorded high-resolution image having an effective line edge placement resolution equivalent to the width of the microelements divided by (2^n-1).

3. A method according to claim 2, wherein said recording medium is a layer of photoresist, a CCD array, or a viewable screen.

4. A method according to claim 1, wherein said step c) includes the step of:

i) directing the plurality of images onto a viewable screen so as to form an apparent image thereon having an effective line edge placement resolution equivalent to a pixel size of the microelements divided by (2^n-1).

5. A method according to claim 4, including the step of directing the superimposed images in a time less than the integration time of the eye.

6. A method according to claim 1, wherein said step a) includes the step of

forming the n = 2 different patterns as similar versions of a single pattern but that include one or more select places having edge positions that are shifted.

7. A method of forming an image having edge placement accuracy to a small fraction of a pixel using an image transducer having coarse pixels, the method comprising the steps of:

a) defining a fine grid pattern comprising a plurality of fine-grid pixels corresponding to the desired image;

b) overlaying the coarse grid pixel array on the fine grid pattern and determining a proportion p of the number of exposed fine grid pixels making up the portion of the fine grid pattern formed in each coarse grid pixel;

c) applying the proportion p to a number of pulse-exposures (2^n-1) to be combined to obtain an n-digit binary integer number N corresponding to each coarse-grid pixel;

d) creating n different binary patterns based on the binary numbers N, wherein the pattern number is based on the order of the digit starting from the right and whether or not the pixel is exposed depends on whether the digit is a one or a zero; and

e) imaging the n patterns in sequence by pulse-exposing the m^{th} pattern 2^{m-1} times for a total of 2^n-1 pulse-exposures, thereby forming a set of superimposed images having an edge placement resolution substantially equal to the width of a coarse grid pixel divided by (2^n-1).

8. A method according to claim 7, wherein said step e) includes the step of recording the superimposed image in a high-contrast photosensitive medium.

9. A method according to claim 7, wherein said step e) includes the step of displaying the superimposed image such that it appears to the eye as a single time-averaged image.

10. A method according to claim 7, wherein said step d) includes modifying the n binary patterns to compensate for image edge position errors arising from optical proximity effects and/or the non-linearities in the edge profile of a diffraction limited

image.

11. A method according to claim 7, wherein said step d) includes the step of defining each coarse-grid pixel as "on" or "off" for each pulse-exposure based on the sequence of binary digits, 1s and 0s in the associated binary number N, so that if the first digit is N is a one, the corresponding pixel is exposed in the first binary pattern, and if the second digit in N is a zero then the corresponding pixel is unexposed in the second binary pattern, and so on.

12. A method according to claim 7 of performing step-and-repeat lithography, further including the steps of:

i) storing the n different binary patterns in corresponding memory arrays in electrical communication with the image transducer; and

ii) recording the superimposed image in a high-contrast photosensitive medium covering a substrate by stepping-and-repeating multiple field exposures, where each field exposure consists of 2^n-1 partial exposures and the field exposures are butted together on the substrate to form a contiguous printed image covering an area larger than the image of the image transducer.

13. A method according to claim 12, wherein in step i) the field exposures are tapered at the edge of the image transducer, and in step ii) the fields are overlapped slightly to ensure a contiguous printed image having no abrupt discontinuities caused by small stepping errors.

14. In a scanning imaging system employing a pulsed radiation source and a digitally programmable image transducer having an array of microelements capable of being irradiated by the radiation source, and an image transducer memory array in electrical communication with the microelements, a method of transferring pattern data stored in pattern memory arrays in communication with the image transducer memory array between pulse-exposures of the radiation source, the method comprising the steps of:

a) dividing the image transducer memory array into 2^n-1 equally sized columns;

b) dividing the pattern data stored in the pattern memory arrays into corresponding sized pattern memory array columns and adding to the start and finish of each memory pattern 2^n-2 columns of ones or zeros, and numbering the pattern memory array columns consecutively from one through x;

c) defining a pattern index start number and setting it equal to 1;

d) transferring 2^n-1 columns of pattern data in increasing numerical sequence from the pattern memory array to the image transducer memory array, with the first of the pattern data columns in the image transducer memory array corresponding to the first column in the first pattern memory array, the next two columns in the image transducer memory array corresponding to the second and third columns in the second memory array, the next 4 columns in the image transducer memory array corresponding to the fourth through seventh columns of the third pattern memory array, and so on, until 2^n-1 columns in the image transducer memory array are filled with data columns from all n patterns stored in the pattern memory arrays;

e) pulse-exposing the pattern on the image transducer and imaging the pattern onto a photo-sensitive substrate and incrementing the pattern start number by one unit, to move the pattern by one column, corresponding to the substrate motion between pulse-exposures; and

f) repeating said step d) and said step e) until the all patterns stored in the pattern memory arrays have been transferred onto the image transducer and pulse-exposed.

15. A method according to claim 14, wherein in said step d), said transferring of data occurs so that at least 1000 bits are transferred into the image transducer in a single clock cycle.

16. A highly parallel data bus architecture for operating a digitally programmable image transducer having an array of microelements that can be divided into in 2^n-1 columns and an associated image transducer memory array comprised of memory cells corresponding to respective microelements for storing a bit of pattern

data that determines the microelement state, the architecture comprising:

a) n memory arrays, where n is an integer greater than or equal to 2, with each memory array capable of storing a low-resolution pattern to be formed onto the microelement array;

b) a parallel data bus electrically connecting the memory arrays to the image transducer memory array;

c) one or more data bus switches within the data bus allowing the data transfer from any one of the n memory arrays to be switched to the image transducer memory array; and

d) a memory control unit electrically connected to the n memory arrays and the one or more data bus switches, programmed such that 2^{m-1} columns of pattern data stored in the m^{th} memory array are sequentially transferred to 2^{m-1} memory cell columns of the image transducer memory array, wherein m is an integer that starts at 1 and increments by 1 until it reaches the value n.

17. An architecture according to claim 16, wherein the image transducer comprises one or more DMDs.

18. An architecture according to claim 16, wherein the data bus has a width of 1000 bits or greater.

19. An architecture according to claim 16, wherein said memory arrays reside in a DRAM.

20. An architecture according to claim 16, wherein said memory control unit is a CPU operating at a clock frequency of at least 500MHz .

21. An architecture according to claim 16, wherein the data bus contains 256 or more lines for carrying pattern data.

22. A lithography system for forming an image with high edge placement accuracy from a plurality of sequentially exposed low edge placement accuracy patterns comprising, in order along an optical axis:

a) a radiation source capable of generating a pulsed beam of

radiation;

b) an image transducer comprising an array of microelements capable of being in an on or off state corresponding to directing radiation to first and second directions, respectively;

c) a projection lens having an entrance pupil for receiving radiation reflected from said digitally programmable array of microelements when said microelements are in one of the first and second states, an exit pupil and an image plane;

d) a moveable substrate stage capable of supporting a substrate at or near said image plane and scanning said substrate during formation of the high-resolution image; and

e) wherein the system further includes an array controller electrically connected to said image transducer and having the data bus architecture of claim 16, for controlling the transfer of pattern data from the n memory arrays to the image transducer memory array between radiation beam pulses.

23. A system according to claim 22, further including an illumination system arranged between said radiation source and said image transducer.

24. A system according to claim 22, wherein said image transducer array includes one or more DMDs.

25. A system according to claim 22, further including a system control unit electrically connected to said radiation source and said array control unit, that coordinates the operation of said radiation source with the data transfer between the n memory arrays and the image transducer memory array between radiation pulses.

26. A system according to claim 22, wherein said radiation source is a laser.

27. A system according to claim 22, wherein the n patterns stored in the n memory arrays are pulse-exposed so as to achieve precise control of the position of each imaged edge of the array microelements to within a fraction of the projected size of a single microelement.

28. The system according to claim 25, wherein the radiation source is controlled to generate 2^n-1 pulses to completely expose a pattern element.

29. A method of patterning a substrate with a high-resolution image having an edge placement resolution finer than that afforded by the individual microelements from which the high-resolution image is formed, comprising the steps of:

a) storing n = 2 predetermined patterns in n corresponding memory arrays in electrical communication with an image transducer memory array in electrical communication with the image transducer microelements;

b) irradiating the image transducer with pulses of radiation so that after moving completely across the image transducer in 2^n-1 steps and being partially exposed at each step, each pattern element is completely exposed on the substrate; and

c) continuously scanning the substrate so that the partial exposures of the patterns remain spatially synchronized on the substrate.

30. A method according to claim 29, wherein the predetermined patterns are similar versions of a single pattern having edge locations that differ by as much as one pixel on the image transducer.

31. A method according to claim 29, wherein:

said method further includes the step of:

i) dividing the memory cells of the image transducer each into 2^n-1 columns; and the patterns in the memory into equally sized columns;

said step c) includes the step of:

ii) transferring, between radiation pulses, 2^n-1 columns of data from the n memory arrays into 2^{n-1} columns in each memory array such that one column is transferred from the first memory array, two columns are transferred from the second memory, four columns from the third array and so on, until 2^{n-1} columns from the n^{th} memory block are transferred to the image transducer memory array columns; and

all the adjacent cells in the image transducer correspond to adjacent cells in the

original pattern and the pattern in the image transducer is indexed by one column after each radiation pulse.

32. A method of patterning a substrate with a high-resolution image having an edge placement resolution finer than that afforded by the individual microelements from which the high-resolution image is formed, comprising the steps of:

a) storing $n = 2$ predetermined patterns in n corresponding memory arrays in electrical communication with an image transducer memory array in electrical communication with the image transducer microelements;

b) irradiating the image transducer with pulses of radiation so that after moving completely across the image transducer in 2^n-1 steps and being partially exposed at each step, each pattern element is completely exposed on the substrate;

c) transferring a portion of each of the n-patterns from the n memory arrays to the image transducer memory array prior to each pulse of radiation using the data bus architecture of claim 16; and

d) continuously scanning the substrate so that the partial exposures of the patterns remain spatially synchronized on the substrate.